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Corrosion Studies Of Aluminum, Iron And Other Metals Using Grazing Angle Infrared Micro-Spectroscopy

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Beamline(s): U2B, U10B

Introduction: The type of oxide passive films formed on iron has been the subject of study for several years. Much of the recent work has focused on the passivity of Fe in alkaline solutions and borate buffers [1-3]. A number of *ex situ* and *in situ* techniques using XANES [4-6] have been used and has led to a fairly good understanding of the electrochemistry taking place. The oxide films can be grown at high pH. Methods are available to form and reduce oxide films with thick layers, which will assist infrared spectroscopy measurements. However, the mechanism of formation and the nature of this layer are not yet clear. Hence we decided to use Infrared spectroscopy to study the type of oxides formed. IR spectroscopy would give information about bond vibrations depending on the type of oxide formed. The main problem affecting the use of *in-situ* infrared technique is the absorption of IR radiation by the bulk of the solution/electrolyte at the interface, specifically if the electrolyte contains water, which absorbs strongly in the mid- and far- IR regions.

Results: We are in the process of designing a suitable electrochemical cell, which would be used to make *in-situ* IR measurements on Fe and Al alloys. A number of *ex-situ* measurements were made on thicker oxides grown on Al, Ta, Zr etc. using Grazing angle IR micro-spectroscopy to demonstrate the technique. Figure 1 shows the growth of the oxide on an Al sample at 10mA/cm^2 to different potentials. Using grazing angle IR micro-spectroscopy, we are able to observe oxide layers as thin as 10 nm on the Al surface. We have also done preliminary *in-situ* measurements with the use of ZnSe and Si hemispherical ATR crystals.

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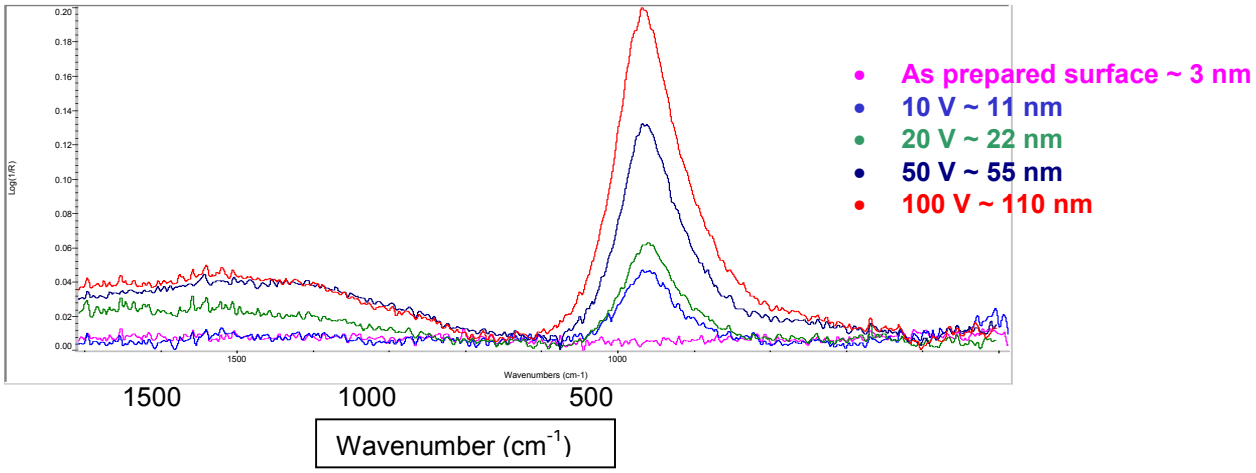

Figure 1. Grazing angle IR spectra of Aluminum oxide grown to different thickness